A SunCam online continuing education course

Campgrounds – The Basics of Design

by

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COURSE DESCRIPTION

Camping is nothing new and dates back to the beginning of human history... though it was full time then and not nearly as enjoyable. Today, the camping experience ranges from primitive 'sleeping on the ground' to luxury 'hotels on wheels'. In recent years there has been a tremendous increase in the number of people seeking new places to explore... seeking escape from the cold, heat, noise, pollution, or even from their hectic daily lives. Whatever the reason, they are headed to state parks, national parks, preserves, environmental areas, wildlife management areas, commercial campgrounds, and RV (Recreational Vehicle) parks like never before. And today, because of those desires, campground spaces are filling up and it is now common to have waiting lists for access to a campsite. As prophesied in a movie... "Build it and they will come."

Tent campsite

RV campground

Today, there is a new breed of campers that is rapidly growing in numbers... the "Workampers". Workamping is a new way for people to live and work yet still experience the great outdoors. They travel around the country and make money by working in the campgrounds or at nearby special events. Whatever their special skills, they travel to new places that need those skills, living and working there until their job is done. And then they're off to their next campground destination. Visit www.workamper.com for more information about this expanding group of RV campers.

And where there are people*... there are regulations*. States regulate public campgrounds for health and safety issues. These regulations may include handicap access, emergency rescue, fire hazards, safety codes, buildings, roads, environmental

impacts... and the list goes on. Even local jurisdictions may impose additional requirements such as landscaping, mandatory forms of recreation to be provided, maximum number of users, maximum camping densities, etc.

This course will discuss the issues that impact the different types of campgrounds. Some examples are potable water supply, sewage, garbage collection, access for emergency vehicles, environmental impacts, etc.

The course will start with discussions of the different "types" of camping experiences found in campgrounds and then discuss some of the codes and considerations that must be incorporated into the final campground design. ***This course is not intended to be all-inclusive*** in the design of campgrounds because every area of the country has different regulatory requirements and differing design challenges. Designing a campground in the Rocky Mountains is considerably different than designing a campground in Florida but both will have the same design components. So this course will focus on the design aspects that are common to all campgrounds.

So, let's get started…

THE BASICS

A typical campground will include one or more camping experiences. For the purposes of this course, we will divide them into three types... primitive, tent, and recreational vehicle (RV). *Primitive campsites* will be those typically used by backpackers and will provide minimal, if any, campsite improvements. *Tent campsites* will be those providing basic services such as water and/or electricity. And *RV campsites* will be those providing extensive services which may include water, sewer, electricity, cable tv, and possibly even internet access.



Primitive campsites, as previously mentioned, provide minimal improvements, if any. Many have nothing more than a small cleared area that "may" be somewhat level. Some may have a few "extravagant" improvements such as potable water or an animal-proof garbage can. Some may even include a picnic table or a fire ring (a metal ring set on the ground that is about six inches high and 24-30 inches in diameter used to contain campfires). Most campsites are relatively isolated and have room for one or two tents. Some campgrounds will provide areas that will support group camping. Most campgrounds providing primitive camping opportunities support the philosophy of "If you want it, bring it with you... but leave only footprints." Most sites are accessible by vehicles but they may be restricted to emergency use by authorities only.

Though lacking in services or modern conveniences, this is exactly what some campers are looking for today. They may be backpackers, bird watchers, hunters, or simply wanting to explore nature. Regardless, many of these primitive campsites are booked up weeks or months in advance.

Primitive campsites are sometimes an economical means of increasing a campground's revenue by providing a larger number of rentable campsites without incurring large investment dollars. Then, when the capital is available to add utility services, the primitive campsites can be converted to tent or RV campsites.

A primitive campsite with only a fire ring and picnic table

A primitive group campsite with a grill, firepit, and tables

Tent campsites are the next 'level' up and provide a cross-over between the primitive campsite and the RV campsite by providing some amenities. Tent camping also includes what is commonly known as "pop-up campers". They are basically tents on wheels. Most of these campsites will have potable water available at the campsite or nearby. Some will even have electricity available as well. All will have a nearby bathhouse with showers, toilets, and sinks. Some bathhouses may even have laundry facilities as well. All will have vehicular access to the campsite with room for a vehicle and a camper or tent.

Tent camping sites

Similar to the primitive group camping sites, some campgrounds provide areas that will support group tent camping. However, many of these group tent camping sites may be located a little farther from the public bathhouses.

Group tent camping site

RV campsites include campers that are towed or driven and provide the closest thing to living at home while on the road. RVs can range in price from about $30,000 to in the millions. But they can have every desired amenity included within their spaces and still be mounted on wheels. They may include beds, bathrooms, kitchens, televisions, heaters, air conditioners, water heaters, microwaves, closets, tables, and more. And they can be quite large. But all have hook-ups... for water, sewer, electricity, and cable. They are typically classified as a "Self-Contained Unit" meaning it is a recreational vehicle that has a flushable toilet, bathtub or shower, hand-washing sink, and internal storage tanks for both potable water and sewage holding.

RV camping is possibly one of the fastest growing sectors of the camping market. Why? Because of the growing number of retirees and because of the features now available in a RV. And the RVs provide these retirees and families the freedom to escape the cold or the heat and do it in comfort. They don't have to pack up every morning, load the car, and then look for a hotel at the end of the day. So if you build it, they ***are*** going to come.

Even though RVs are self-contained, RV campgrounds are still required to provide the services that support them. This includes roadways, utilities, bathhouses, garbage facilities, and sewage dump stations.

A luxury RV camper - notice the "slide-outs" which provide additional floor space

Another RV camper with a "slide-out" in the rear

TYPICAL CODE REQUIREMENTS

Now that we've discussed the three types of camping found within campgrounds, let's look at the design and code requirements for each. Remember to always check the local codes for any additional zoning or development requirements in addition to the state and health department requirements.

On a cautionary note, I've been requested to provide assistance on several campground design projects because the project engineers weren't experienced in campground design, didn't know which agencies regulated campgrounds or hadn't checked them, and often were behind their client's development schedule. Don't get caught in this position. If you don't have the expertise, I recommend that you seek an experienced campground engineer that can guide you. Whatever you do, don't rely on the regulatory reviewers to catch your design flaws because many of them aren't knowledgeable of campground design issues either. Just because you receive a construction permit doesn't mean there aren't costly design flaws in the construction plans. Bad experiences can be great... albeit painful... teachers.

Many developers... and engineers... fail to consider all of the codes applicable to a new campground design. There are *Health Department* codes that address public health concerns, *zoning codes* (if applicable) that address permitted uses of land, *development codes* that address how a property will be constructed including access and stormwater management, *building codes* that regulate structures and ADA issues, and *utility codes* that address water, sewer, electrical, and communication requirements. And then there are the non-regulatory issues that fall under the classification of "*good engineering practice*"... for example wayfinding, pedestrian circulation, crime deterrence, and addressing camper preferences or needs.

Health Department Codes regulate the public environmental health issues. Some of the more typical code requirements are:

1) Proper grading of stormwater away from the campsite such that there is no standing water in, or runoff through, the campsite.

2) Campground density limits. The term "Campground Density Limits" is defined as the maximum number of campsites allowed per acre of land. The density normally is determined by the type of campsites. *Note that the maximum number of campsites allowed is calculated by multiplying the permitted density by the amount of land available for development. However, some jurisdictions will only allow 'useable' land in these calculations. Jurisdictional wetlands, water bodies, or inaccessible land will be excluded in these situations. So it is critical to know whether the "land available" is calculated using the total property owned or the useable land available.*

3) Potable water requirements regulating services, connections, and availability. These regulations determine which campsites are provided potable water connections, protection for potable water connections, backflow prevention devices, and the requirements for potable water supply stations.

4) Non-potable water regulations set the required signage and separation of non-potable services from potable water sources. Non-potable water may be permitted for vehicle washing or rinsing at sewage dump stations, etc.

5) Sewage disposal requirements for RV campsites and protection of the sewer service connections. Sewage dump stations may be required even if every campsite has a sewage connection. I've permitted campgrounds with and without sewage dump stations so check the local code requirements. The area required to install a dump station may cost you one or two campsites... so it's worth investigating.

CAMPGROUND SERVICES

All campgrounds must provide basic services for bathing, garbage collection, sewage dump stations, and fire protection. And these must be installed in accordance with the local/state codes and regulations.

BATHHOUSES address the bathing regulations by providing showers, sinks, and toilets. The total number of campsites will determine the required number of toilets, sinks, and showers. The campground layout will determine the required number of bathhouses. The size of each bathhouse is determined by the number of campsites within the bathhouse's service area.

Bathhouses are excellent locations for information kiosks or boards

The bathhouse service area is defined by the local regulatory agency but is typically the number of campsites located within 250-feet of the bathhouse and is measured by one of two methods. First, it may be measured as a 250-foot radius from the center of the building, the nearest entrance, or the nearest corner of the building. You'll need to verify this with the local codes. Secondly, it may be the distance of the route a camper must travel to reach the bathhouse. Obviously, this can make a tremendous difference in the size of each bathhouse, the number of bathhouses required in a campground, and where they are placed in the campground.

Bathhouse with solar water heater placed on roof. Also notice the information board on the wall

So, the closer the campsites are to each other, the greater the number of campers within the service area of the bathhouse which, in turn, determines the number of showers, sinks, and toilets required in the bathhouse. For this reason, a long narrow campground property that limits bathhouse access from only 2 or 3 sides will require more bathhouses (but smaller in size) than a property that allows campsites to surround a larger bathhouse.

SEWAGE DUMP STATIONS are typically required for all campgrounds that serve RV and trailered campers that have internal bathrooms. Normally, they are located at a dedicated site with pull through drives. For high volume campgrounds, the dump station may be located between two service drives which allows it to serve two RVs

simultaneously. They generally require a trapped four inch sewer riser pipe that is connected to an approved sewage system. It is usually installed in a concrete apron sloped to the drain and provided with a hinged cover. A water supply outlet for wash down is also required. Additionally, a sign must be posted immediately adjacent to the wash down hose stating “WATER NOT SAFE FOR DRINKING”.

Examples of dump stations found in various campgrounds

GARBAGE COLLECTION is regulated differently depending on the local codes. They can range from garbage cans to large screened-in dumpsters. Some areas even require recycling bins. But all campgrounds require some means of garbage collection.

Garbage cans - Some codes require that garbage cans be located at each site. If this is the case, animal-proof garbage cans that are secured are recommended. They may be chained to a post with a locking lid or they may be contained in a secured metal or wooden cage. There are many designs available but choose one that is easily accessible by campers and are easily maintained by staff.

Garbage dumpsters have a greater storage capacity and reduce the number of pick-up locations. However, they also must be provided a larger area that is accessible by a garbage truck. Because of their lack of "curb appeal" and the fact that no camper wants to spend the night sleeping next to one, they must be strategically designed into the overall campground plan. Many areas of the country require that the dumpsters be screened from view by fences or walls. Some even require that the screening wall match the architectural style of the buildings located in the campground. Check the local codes for their design

requirements.

***Recycling bins** are now frequently required in many jurisdictions and must be co-located with the garbage collection containers. Again, check the local codes for their requirements.*

PRIMITIVE CAMPSITE DESIGNS

Many believe that there is no design involved in primitive campsites. They believe that a camper just hikes until he finds a location that he wants to camp and then sets up. However, in most cases, that's not permitted nor is it desired. Without designated primitive campsites, the negative impact to the environment is increased because users continue to clear new campsites, dig more fire pits, leave more garbage behind, etc." Another issue with non-designated campsites is when an emergency arises, locating and rescuing an injured camper can be extremely difficult. So a campsite needs to be located in an area that provides easy access for staff and emergency crews, where the number of campers can be controlled, and the impact to the environment can be minimized.

A primitive campsite near a lake

Regulatory Codes for primitive campsites vary widely from none to limited. Some regulations include stormwater drainage, access, and water services. So, again, check your local code requirements before you begin your campsite selections. It can be quite costly to provide potable water service or emergency access routes to remote locations.

Campsite drainage is an important aspect of site selection. Some codes require the primitive campsites to be free-draining during storm events with no standing water or stormwater run-off through the campsite permitted. Even if there are no codes requiring this, it is still a good design practice.

Emergency access is another consideration, and may even be required, in the event of life-threatening accidents. Vehicular access may be restricted to staff or emergency vehicles use; or, it may provide limited access which allows campers to drop equipment at their site and then relocate their vehicle to a designated parking area. If emergency access is a requirement, a stabilized route from the campsite to a paved road must be provided. Generally, a stabilized one-lane drive will meet these requirements.

Water service, if provided or mandated, must comply with public health code requirements regardless of whether if it is potable or non-potable. If non-potable water service is provided, there must be signage indicating that it is non-potable. Obviously, most primitive campsites will not have water service at the campsite but others may have a hand-pumped well available nearby.

Garbage receptacles are often provided at primitive campsites to protect the environment from trash and protect campers from animals. If provided, the containers must be secured and animal-proof.

Other primitive campsite improvements worth considering are level campsite pads, fire rings, and tables. Even primitive campers prefer to sleep on a level site. And a simple fire ring can certainly provide an increased level of protection from wildfires. Picnic tables are occasionally provided as a convenience and they will certainly be used if provided.

TENT CAMPING DESIGNS

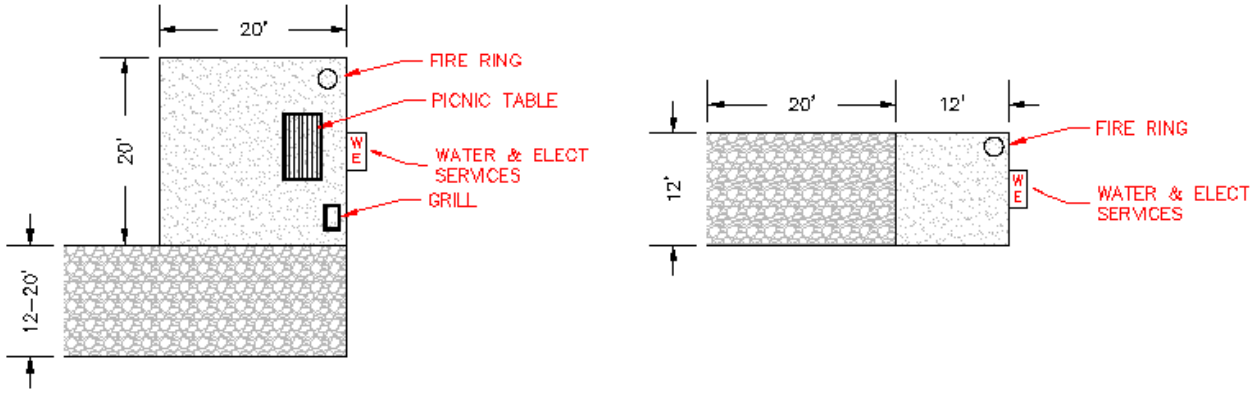
Though an RV will occasionally show up in a tent camping area, tent camping areas are typically used by true tents or tent pop-up campers. Many RVs will find it difficult or even impossible to navigate the tent camping drives but I've even found RVs in primitive campgrounds. And the fact that they even got there is shocking.

Regulatory Codes for tent camping vary widely from location to location. However, most will have regulations covering campsite size, stormwater drainage, access, water services, electricity, and garbage collection. So, always check your local code requirements for the specific code requirements before you begin your campground design.

Design - Tent camping sites are typically small in size with just enough room for a tent and a vehicle. They can be oddly shaped to work around existing vegetation or natural features. The typical tent camping site is approximately 12-ft by 30-ft in size for vehicular parking with a 20-ft by 20-ft camp pad to the side but can be smaller if needed. This provides sufficient area for a vehicle, a tent, a table, and a grill and/or fire pit.

In tight spaces, they can be arranged so that you have a smaller camp pad directly behind a vehicle parking space which would make the campsite about 12-ft by 32-ft. Or it can be configured such that there is a 12-ft by 20-ft space for a vehicle with a 12-ft by 12-ft camp pad to the side. However, the larger 20-ft by 20-ft camp pad located to the

side of a 20-ft x 30-ft vehicular space is becoming more popular today as it provides room for 2 vehicles and camping accessories.



The sites can be straight, angled, or they can be L-shaped. However, pop-up campers will require a straight space for the car and the camper. Access into the camper is through the passenger's side of the camper. If the pop-up camper has an electrical connection, it is typically located on the driver's side of the camper so electrical and water services should be on the driver's side of the campsite. Remember, the camper will be backing into the campsite so ensure the hook-ups are on the correct side and are protected with a bumper post or bollard that is easily visible by the driver. Alternatively, the services may be placed at the rear of the campsite. Whenever possible, consider providing a few pull-through campsites. Not every driver is experienced or proficient in backing trailers.

The campsites should be relatively level and free of rocks, roots, vegetation, and other obstructions. They should also be well drained with any stormwater being directed away from the campsite.

Utilities - Electrical service is typically supplied by a 110-volt 20-amp circuit in a weatherproof box. Water service may be provided by one or two hose bibs on a 1/2" water pipe. The electrical and water lines should be buried 30 – 36 inches below the surface to protect them from tent stakes and poles being driven into the ground.

Amenities - Grills, tables, and fire rings are other campsite items that may be provided. Many tables are now being anchored to ensure that tables are not moved or relocated to other campsites.

Campgrounds with tent camping will also be required to provide a bathhouse for showers, toilets, and sinks. ADA access may be required to all bathhouses or to selected ones depending on the size of the campground and the local codes. This will require careful consideration of site grading, sidewalks, parking, drainage, etc. to comply with the ADA codes.
If laundry facilities are being provided, the washwater discharges must be handled in accordance with local codes. This may require a separate drainfield or other sewer connection. Check your local health department codes.

RV CAMPING DESIGNS

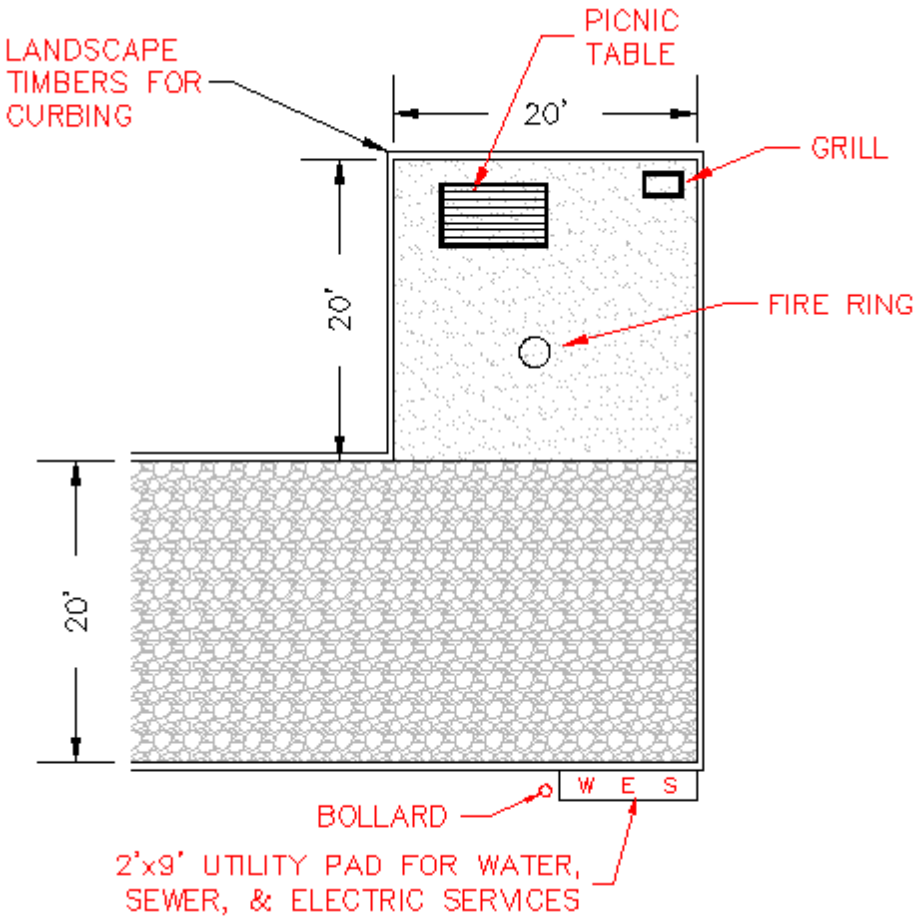
RV campgrounds seem to be growing exponentially. Many are being booked months in advance and have lengthy waiting lists. Though RV campgrounds are much more expensive to design, permit, and construct, most new campgrounds today are being designed for RVs. Many of the RVs are the size of fire trucks so access and maneuvering room are critical in the design of these campgrounds. Because of these issues, it becomes much more complicated to complete a campground design while still minimizing environmental impacts to the area. Most people would prefer their campgrounds not resemble a shopping center parking lot. As campground designers, we need to take advantage of the opportunities that the land has to offer whether that is water, land, vegetation, or wildlife and yet still follow good engineering practices. The focus should be on nature and not on roadways so if possible use curving roads to minimize long views of asphalt which will also help keep traffic at slower safe speeds. Try to preserve as much vegetation as possible and use it as a buffer between campsites and facilities. Try to keep the service utilities within the roadway or pedestrian corridors. Obviously these goals are not always attainable but we should always strive for them.

The typical RV has the water, sewer, electrical, and cable connections located near the rear of the vehicle on the driver's side. The access into the RV is on the passenger's side of the vehicle. Many RVs also have slide-outs that increase the size of the interior space which can create problems for RVs in tight campsites. I've seen campsites so close together that the slide-outs are only useable by the first arriving camper. Later arriving campers had no room available to open their slide-outs which becomes a constant source of irritation... especially if the first RV leaves to run into town for dinner and later returns to find the adjacent RV had taken advantage of their absence to extend their own slide-out. Avoid these problems by addressing RV campsite needs during the design and not when the owners start calling you about these conflicts once the campground is open to the public.

Regulatory Codes for RV campgrounds are tightly regulated by health departments and regulatory agencies. All will have regulations covering stormwater drainage, access, traffic circulation, water and sewer services, electricity, garbage collection, and development densities. Basically, you have a mobile home community set in a park environment. So you must always check your state and local regulatory agencies for the specific code requirements *before* you begin your campground design.

Design - RV campsites are larger in size and drives that access the sites must have larger radius curves. Oddly shaped campsites don't work well with RVs and therefore are much more difficult when dealing with vegetation and natural features. The

preferred RV campsite is approximately 20-ft by 50-ft in size with an adjacent 20-ft by 20-ft camp pad as shown in the exhibit below. These campsite dimensions provide sufficient area for the RV, a second vehicle, a table, a grill, and a fire pit. Some smaller sites can work in an RV campground but will require better management of site assignment to avoid problems with a large RV not fitting into a smaller site.



The RV sites can be straight, angled, curved, or L-shaped... however, motorhome and trailer campers will require special maneuvering considerations for the vehicle and/or the trailer. Water, sewer, and electrical connections are typically located on the driver's side of the camper so the service connections should be on the driver's side near the rear of the campsite. Remember, the camper will be backing into the campsite so ensure the hook-ups are on the correct side and are protected with a bumper post or bollard that is easily visible by the driver. Whenever possible, consider providing a few pull-through campsites. As previously noted, not every driver is experienced or proficient at backing into spaces. Additionally, ensure there are no low overhanging

tree limbs that can cause damage to the camper. If there is a low hanging limb that cannot be removed, the low clearance needs to be signed and clearly visible. Remember, drivers always seem to focus on ground clearances and other ground obstructions and never seem to notice the overhead conflicts until it's too late.

Like the tent camping sites, the RV campsites should be relatively level and free of rocks, roots, vegetation, and other similar obstructions. They, too, must be well drained with any stormwater being directed away from the campsite. Many RVs have the ability to self-level the RV through the use of manual, electric, or hydraulic leveling jacks but the campsite must be relatively level to begin with... all four corners of the parking pad should not exceed 4 inches of elevation difference or 6-8 inches in extreme cases. Anything greater than 4 inches will usually require the use of jack blocks to level the RV. Why?... The reason is that most RV jack levelers will not lift a tire completely off the ground because the tires are needed for the RV's lateral stability. So grade the RV pad appropriately with a consistent gradient from front to back and side to side so as to avoid twisting the RV frame. This is critical because the slideouts on RVs will not extend if the RV is not within its specified level limits.

Utilities - Electrical service is typically supplied by 20-amp, 30-amp, and 50-amp circuits in a weatherproof box. If 50-amp service is not available, the RV must use an adapter to connect to the 30-amp service but the 30-amp service will restrict the usage of some of the RV's equipment like heaters and air conditioners. The Square D PAK75PG Power Outlet Panel is one example of a 20-30-50 amp power pedestal. For a 20-30 amp power pedestal consider the Square D PAK41PG pedestal. Another option is a pre-wired NEMA 3 R enclosure.

20, 30-amp services
with circuit breakers

20, 30, 50-amp services
with circuit breakers

Water service is provided by one or two hose bibs on a 1/2" water pipe. Notice the yellow painted bollard protecting the water and electrical services located in the utility pad.

Sewer service is provided by a 4" sewer service connection. Most RVs use a 3" sewer hose with a 4" adapter to connect to the campground's 4" sewer service connection.

The electrical and water lines should be buried 36 inches below the surface to protect them from tent stakes and poles being driven into the ground.
Communications connections for cable TV and internet are becoming more common and are typically post-mounted adjacent to the water and sewer services.

Amenities - Grills, tables, and fire rings are often provided in RV campgrounds. Tables need to be anchored if it is important that the tables not be moved or relocated.

RV campgrounds are also required to provide bathhouses for showers, toilets, and sinks. ADA access may be required to all bathhouses or to selected ones depending on the size of the campground and the local codes. ADA access issues will require careful consideration of site grading, sidewalks, parking, routes, etc.

If laundry facilities are being provided, the washwater discharges must be handled in accordance with local codes. Since most RV campgrounds have large sewage flows, they are typically connected to a public sewage collection system that discharges into a wastewater treatment plant. Check with your local utility department for connection requirements and fees. If no sewer services are available in the local area, a wastewater treatment plant may need to be constructed to serve the campground which presents an entirely different set of design and permitting issues. Operating a RV campground on a septic system will significantly limit the number of RV campsites. Again, verify the location's available water and sewer services.

DESIGN CONSIDERATIONS

Campgrounds are not commercial shopping centers nor are they residential subdivisions. So you can't use the same design criteria for vehicular traffic patterns or turning radii because campground drives aren't highways or parking lots and they must accommodate a number of natural obstructions like trees, rock outcroppings, creeks, elevation changes, etc.

Campground Access - The campground access from public roads will be regulated by the county, Parrish, or the State depending on who controls the roadway where the campground is located. A turn lane or lanes may be required depending on the size of the campground, the speed of the main road, the roadway gradient, number of lanes, peak hour traffic counts, and site distances. RVs and trailers don't decelerate quickly or make quick turns into campground entrances so right-turn and/or left-turn lanes may be needed for traffic safety. Consult a traffic engineer for the improvements needed for the campground access.

Lane Widths – The campground drives for RVs and trailers should be 20-24 feet for two-way roads and 12-20 feet for one-way roads. A good design practice is to make one-way roads that are 20-feet in width which include a 6-foot wide pedestrian walkway. This provides RVs the maneuvering area needed to back into a campsite while still providing safe pedestrian access through the campground. Campers are friendly out-going folks that enjoy meeting other campers and are very considerate in stopping and providing assistance to a fellow camper trying to get into a campsite. Another nice feature of 20-foot wide one-way roads is that they can become two-way roads during emergencies.

A paved campground drive with the campsite numbers painted on the pavement with a striped pedestrian lane. Notice that this campground mixes pull-thru

sites with back-in campsites.

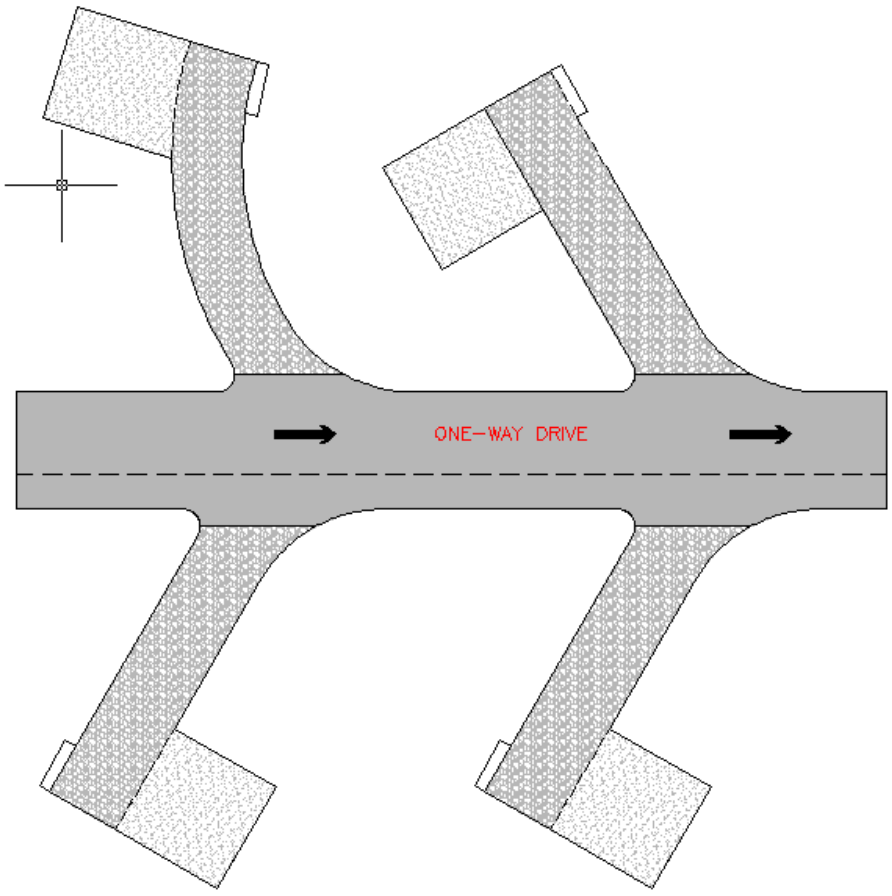
One-way Roads – One-way roads work very well in campgrounds and help to increase pedestrian safety. Two-way roads can be used but extreme care must be utilized to avoid turning conflicts for campsites. One-way roads with pedestrian lanes are the preferred design choice since they limit conflicting traffic, provide a safe zone for pedestrians, and provide additional maneuvering room when needed.

Design Speeds - Vehicle speeds must be kept slow due to the pedestrian nature of campgrounds and local wildlife. Don't forget that they will be used by campers of all ages... by the elderly on leisurely strolls to young kids darting in and out of the travel lanes. Most campgrounds are posted at 5 or 10 mph. In many cases, the sight distances are quite short due to sharp turns and may have dense vegetation screening campsites which can obstruct sight distances even more.

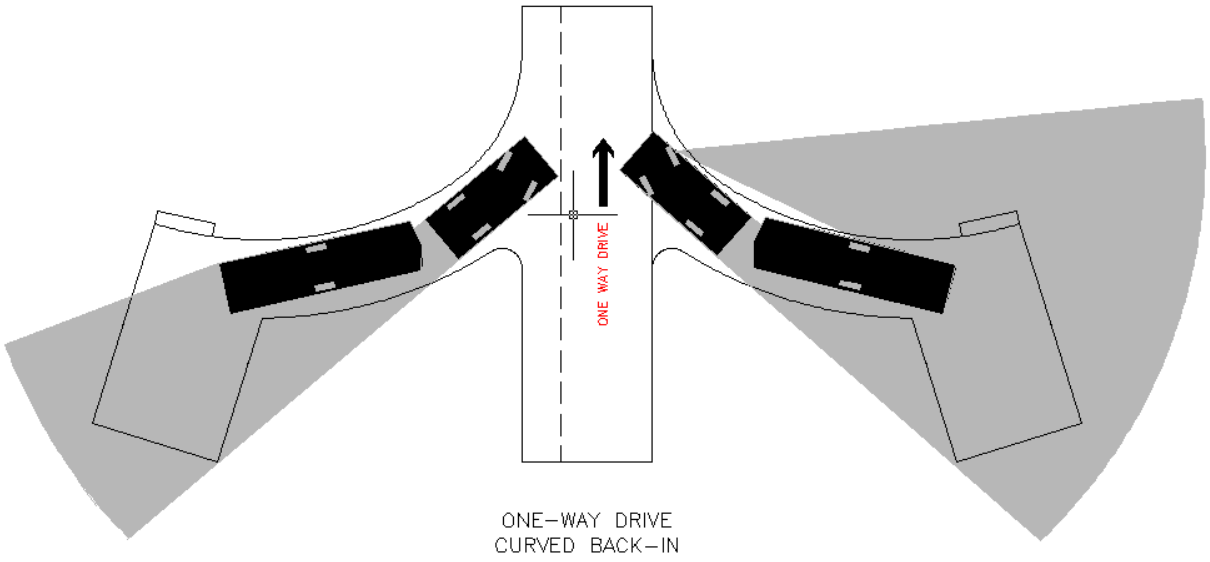
CAMPGROUND GEOMETRY

Campground geometry is very important in developing a successful campground with a good reputation. It doesn't take long for word about a new campground or a recently renovated campground to spread among camping enthusiasts. Camping trailers and RVs need plenty of maneuvering room. Inside turning radii should be no less than 25-feet but as large as practical. Angled RV pads (30 to 45-degrees) located off of one-lane roads work best because they require less turning area and offer better sight lines.

Try to orient the RV pads such that the headlights of the RV are not shining directly into the camper opposite it. A neat trick is to use a curved RV pad to control headlight directions or for flexibility to avoid removing natural features such as a tree or rock outcropping.



Note that curved campsites should only be used on one-way drives and then only on the left side of the road for two simple reasons. One, a driver backing into a curved site can see where he is going. Two, trying to navigate into a space on a two-way drive is very hazardous because the driver's focus is on navigating into the campsite and he is not watching for on-coming traffic. Note that if the parking area is curved to the right, his view is obstructed by the RV/trailer and he is backing in blind. In the graphic below, the shaded areas simulate the driver's blind spots and show why it's so difficult to negotiate a right curved RV pad.



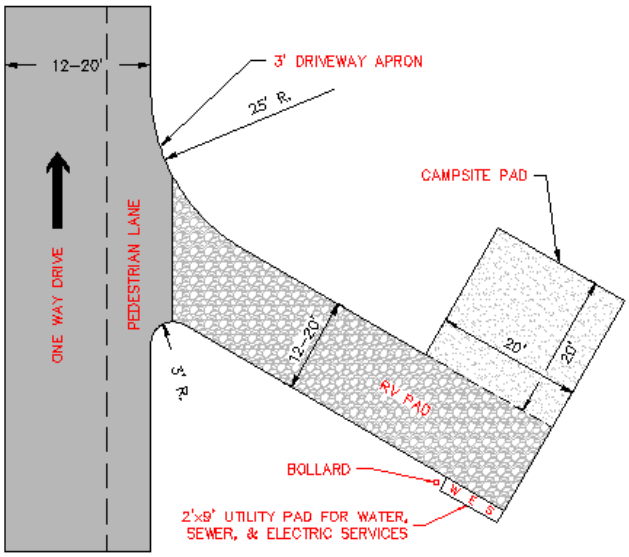
Driver Blind Spots

One-Way Drives

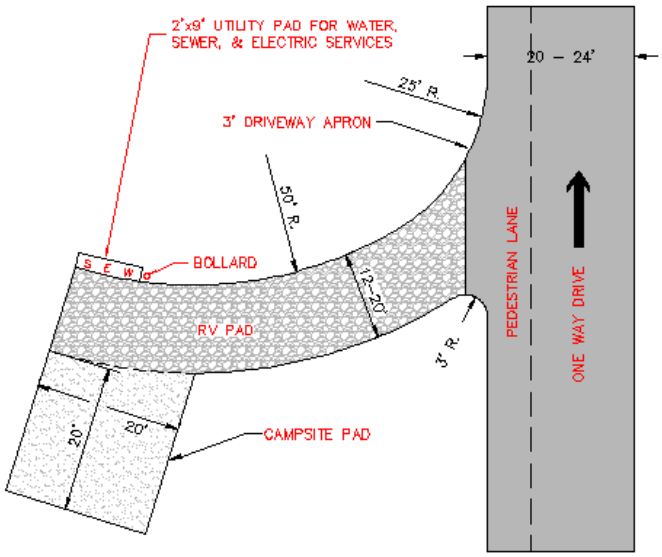
One-way drives are highly recommended for several reasons. First, they provide quick easy access to campsites, require less maneuvering room to get into the campsite, minimize congestion on the drives by drivers not blocking two lanes of traffic when backing into campsites, and increase safety for drivers and pedestrians by limiting traffic flow to a single direction.

Below are a couple of photos taken at an RV campground and show two campsites using an angled RV pad, camp pad with fire ring, grill, and a picnic table at each site. This campground design uses asphalt paved drives, gravel RV pads, and gravel camp pads.

Two examples of campsites located on one-way drives are provided below with the dimensions and radii used in their design. Notice the radius that is used on the curved campsite. The radius should be as large as practical but not less than 50-feet or the RVs may not be able to get into the campsite without damaging the RV, the driveway, or the grounds.



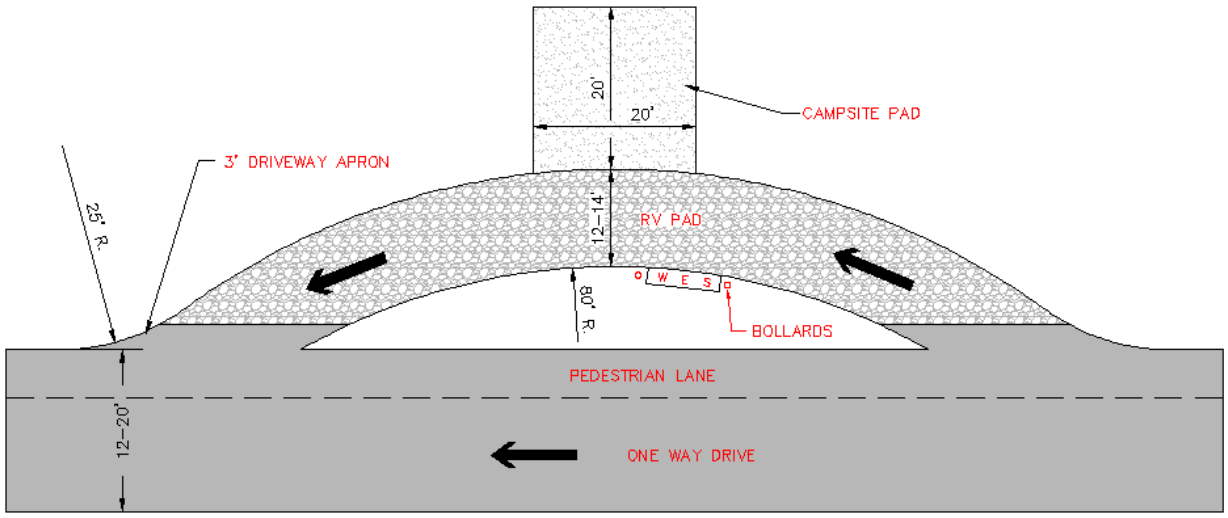
ONE–WAY DRIVE
STRAIGHT BACK–IN



ONE–WAY DRIVE
CURVED BACK–IN

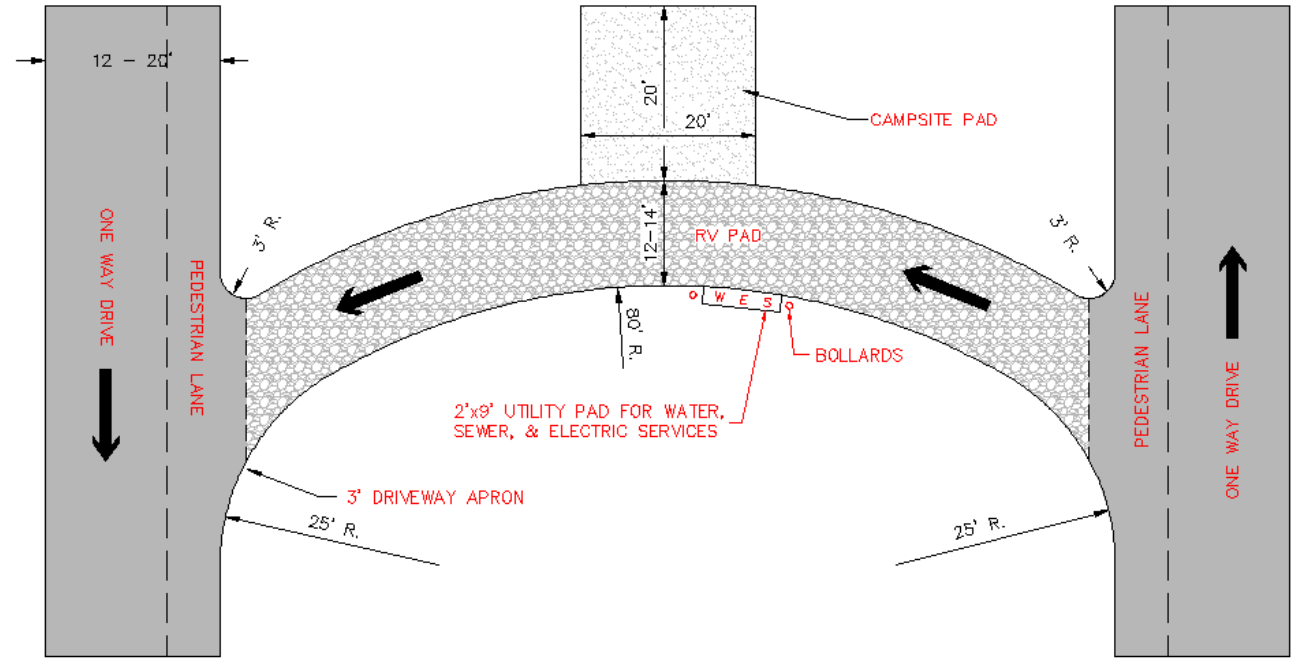
Pull-thru Campsites

Pull-thru campsites are very popular with campers because of their ease in getting in and out of the campsite... no backing required. The most common pull-thru campsite is the outside loop pull-thru. It is positioned on the right side of the campground drive on one-way drives but can be used on two-way drives as well. The inside radius of the drive is usually 80-feet but may be adjusted for site conditions. Obviously, the larger the radius the easier it is to navigate, but it's size also begins eating up valuable real estate. So consider the environment, terrain, vegetation, and visibility issues when determining this radius.



OUTSIDE LOOP PULL-THRU

The inside loop pull-thru campsite is a good design when the area between two campground drives is limited. It can provide an efficient use of the limited space and still provide easy access. Because of the potential for an RV to enter the campsite in the wrong direction, this concept is not recommended for use on two-way roads.

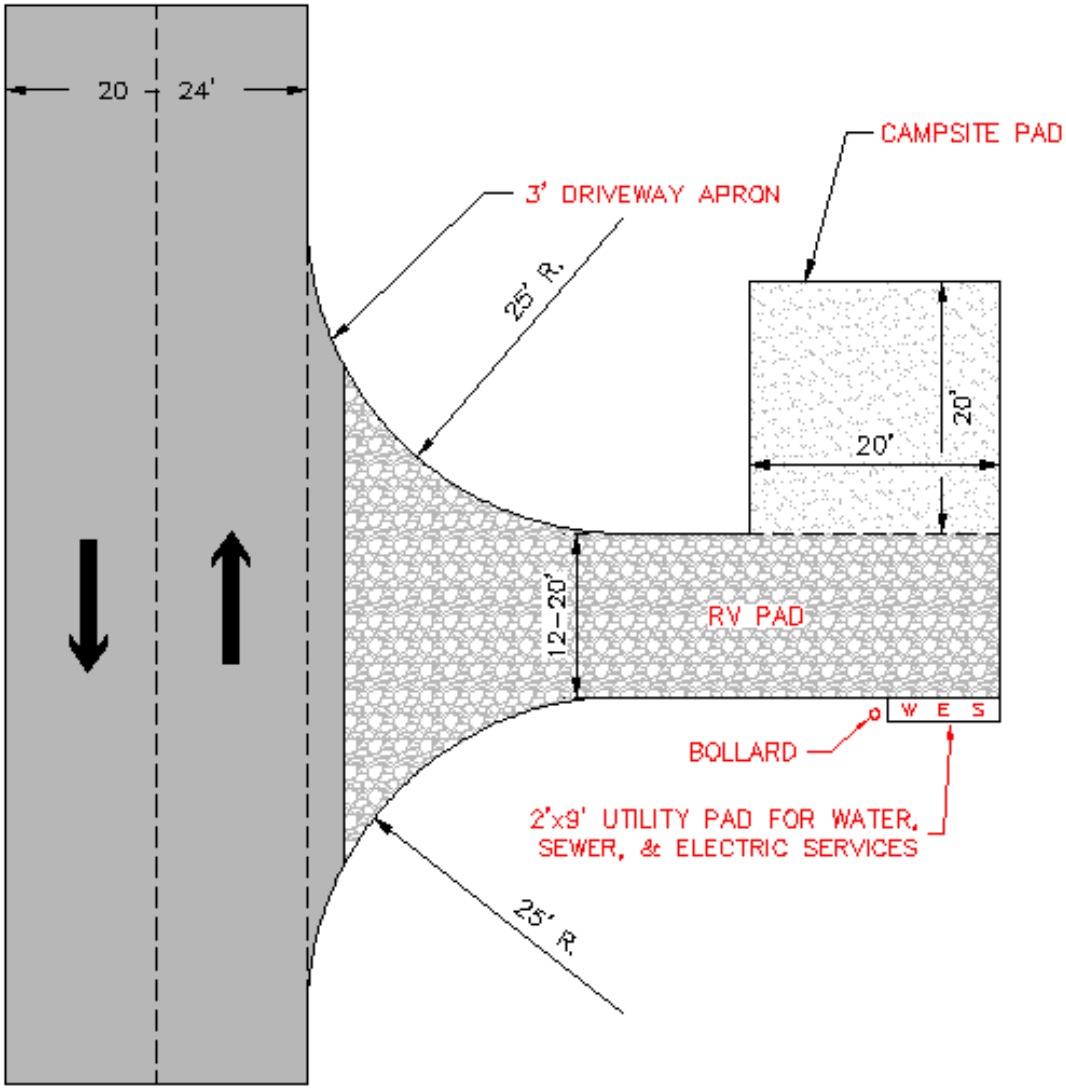


INSIDE ONE–WAY LOOP
PULL THRU

Two-way Drives

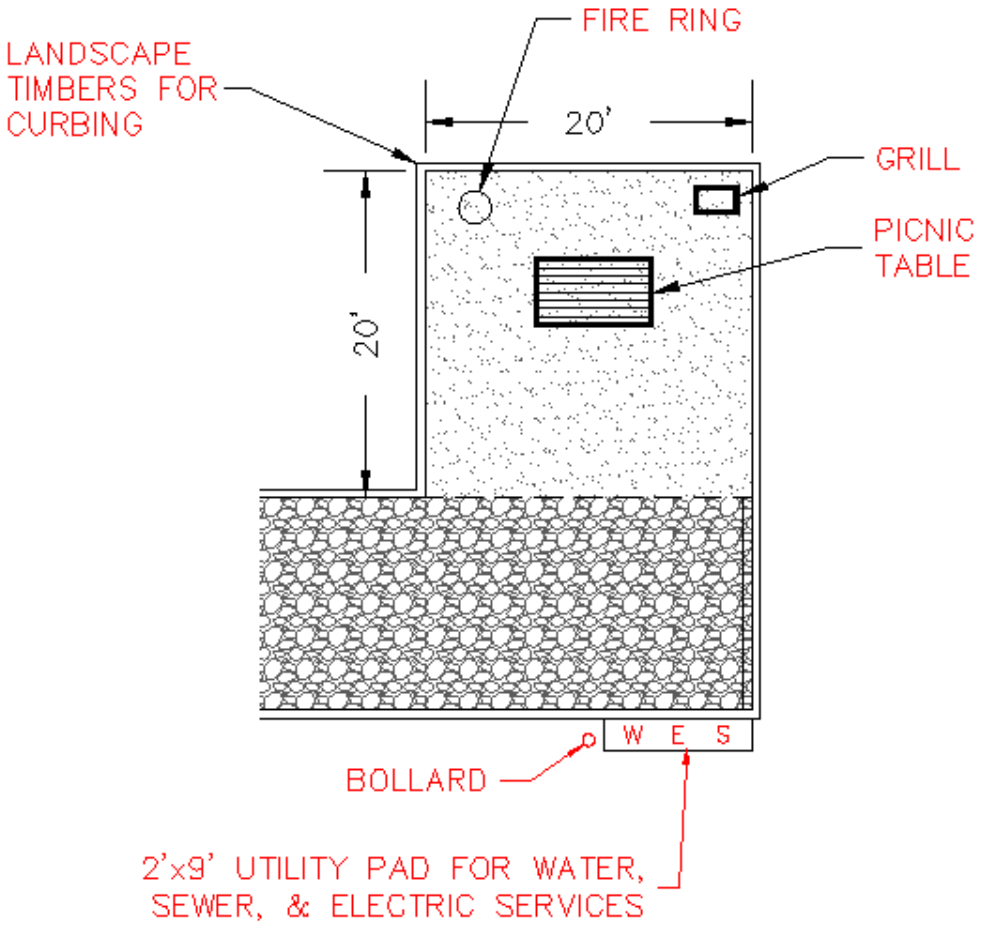
Campsites located on two-way drives are typically configured for 90-degree RV pads which provide access to vehicles approaching from either direction. Two-way drives will be 20-24 feet in width with a 3-foot apron at the campsite. The 3-foot apron protects the edge of pavement from damage. The typical RV pad is 20 feet x 50 feet but can vary

from 12-20 feet in width and 30-60 feet in length. A 20-foot width is recommended as it allows a second vehicle to park adjacent to the RV while a 12-foot width requires a second vehicle to be parked in front of or behind the RV... or parked on the main drive itself which will cause congestion and headaches for all.



TWO–WAY DRIVE
STRAIGHT BACK–IN

Camp Pad Design – The camp pad provides the "living" area for the campers. A 20-foot by 20-foot camp pad will comfortably fit a campfire ring, a charcoal grill, and a picnic table which leaves ample room for a sitting area adjacent to the RV. If the camp pad is unpaved, landscape timbers or railroad ties help provide a finished look to contain the aggregate (sand or pea gravel). Many campgrounds are now using artificial landscape timbers because they are durable, splinter free, and non-toxic.



Most campgrounds will provide a fire ring for the simple reason that it provides a safe method of containing the ever popular campfire. Many are no more than a simple metal ring installed on the ground in the corner of the camp pad or placed between the table and the RV so that campers can sit around the campfire in the evenings. A couple of nicer campfire rings available are the Fire View Ring and the Non-Adjustable Campfire Ring shown below. Both are available from Jamestown Advanced Products (http://www.jamestownadvanced.com).

Some campgrounds will provide grills for the campers to use. They are typically rugged metal grills designed to stand up to abuse and harsh climates. If installed, they need to be securely anchored to prevent them from being accidentally overturned. Always place the grills away from vehicular areas for obvious reasons.

The Standard Park Grill also available from Jamestown Advanced Products.

Picnic tables are readily available from multiple sources and styles. They may be constructed of wood, metal, concrete, or a combination. The owner should be consulted as to whether the tables remain portable for individual camper preferences or are anchored and secured against theft or relocation. It's surprising how many of these tables disappear each year.

Obstructions – Overhead obstructions need to be identified and signed. The most common obstructions are overhead power lines and tree branches. These need to be identified by the land surveyor on the topographic survey and then field verified so that they can be incorporated into the design or field modified as necessary. One state park in Florida has a large live oak with a 24-inch diameter limb that extends across the roadway. Just prior to reaching the limb is a sign that warns of a low clearance. However, that has not stopped it from removing roof-mounted air conditioners, antennas, satellite dishes, and sky-lights that drivers had forgotten about.

Traffic Calming – Traffic calming is best accomplished with posted speed limits, curves, pedestrian crossings, limited sight distances, and stop signs. Avoid the use of speed bumps which are noisy (from vehicle braking, engine acceleration, and tire impacts) and may dislodge items inside RVs and trailers. Speed is not typically a problem in campgrounds because of the pedestrian emphasis found there but long straight roads will tend to increase vehicle speeds.

Drainage – Stormwater management is always an issue in campgrounds. Treatment of stormwater runoff is often at odds with minimizing environmental impacts. If you're dealing with a wooded area, clearing a large area for a stormwater treatment system is a contradiction in land management. Stormwater management is best accomplished using shallow drainage swales, natural depressions, or sheet-flow across vegetated buffers where permissible.

Consider using pervious pavement instead of solid concrete or standard asphalt. Pervious asphalt or pervious concrete works well in many of the warmer areas of the country requiring only minimal maintenance... with that being the need to spray the surface with weed-killer each Spring to prevent vegetation from growing up through the pavement.

Poor drainage at campsite - notice utility services are located in standing water

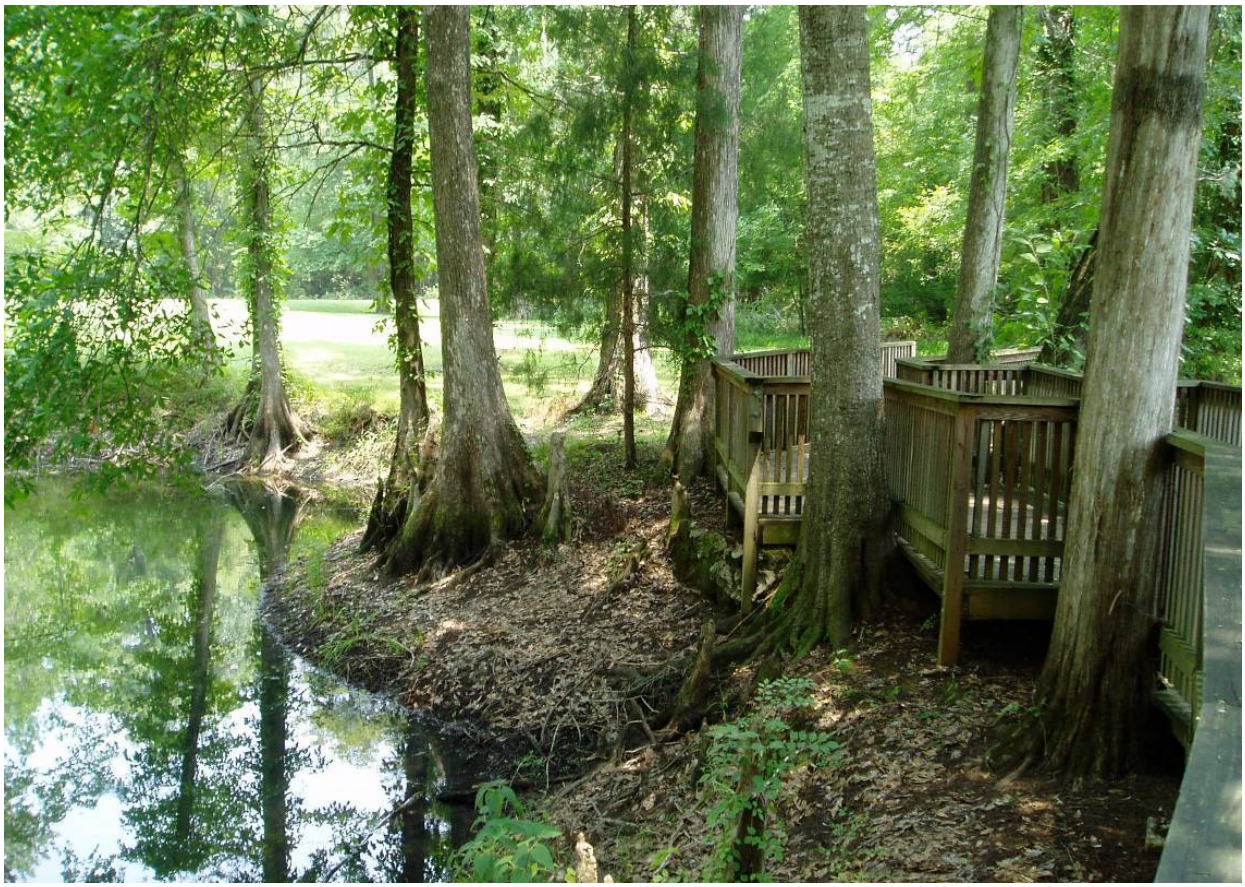
Site grading should be designed so as to direct stormwater flows away from or around campsites, not through them. And there should be sufficient slopes to prevent any ponding of water which can become a mosquito breeding ground. Most health departments will prohibit areas of standing water within campgrounds because of this. Additionally, if drainage swales are used, there must be a dry access route to the campsite provided for pedestrians.

Water preventing pedestrian access to campsite

Good campground designs call for drainage swales to be located outside of campsites

Sidewalks and Trails – Designated sidewalks and trails should be provided throughout the campground. Only those required by ADA codes need to be concrete, paved, or stabilized enough to meet the code requirements. The remaining trails may be natural soil, grassed, or mulched. Remember that even if the roads are not designated or striped for pedestrian use, they will still be used by the campers to reach bathhouses, camp stores, pools, etc. Sidewalks and trails should be at least 5 to 6 feet in width and free of obstructions, wet areas, and vegetation. If wet vegetated areas or ditches need to be crossed, provide boardwalks across these areas.

Even areas with many obstructions can be navigated without removing the obstructions, as shown in the picture below.



Boardwalk guard railings should have a slat spacing no greater than 4 inches in width to prevent injuries to children from putting their heads through the slats or constructed with a wire mesh. And if the boardwalks are installed in a normally damp or wet climate, the use of slip-resistant applications on the deck boards are recommended.

Note the slats spaced at 4" widths in the guard railing

Garbage Containers – Many jurisdictions have codes that specify the number of garbage containers required, their spacing, screening, and security from animals. Even if there are no codes, it is good practice to screen the garbage containers from view with fences, walls, or vegetation. Animal proof containers with self-closing lids are essential in preventing problems with animals scattering garbage or confrontations between animals and campers. Some garbage cans utilize heavy metal lids to secure garbage from wildlife.

If the garbage is being collected by garbage trucks with mechanical lifts, sufficient maneuvering room is mandatory for the trucks to get access to the containers.

Fully and partially enclosed garbage container enclosures allow for easy camper access but they remain secured from animals. Notice that recycling bins are located here as well. The type of garbage enclosure will be determined by the type of animals you're trying to keep out.

ADA Issues – Just as the number of campers are increasing, so are the number of physically challenged campers. This requires specially designated campsites, easily accessible bathhouses, and all necessary ADA ramps. These issues are the same that are encountered in any commercial development but perhaps the biggest challenge is providing them to those that need them while still providing an enjoyable camping experience. Too often, engineers are placing the ADA campsites immediately adjacent to the bathhouses. While this makes for a very efficient design and shorter sidewalks from the campsite to the bathhouse, it can dramatically detract from the camping experience because of the increased noise and the number of people going to the bathhouse all during the day and night. This is where creative site designing and landscape screening is really needed. The ADA campsite should be no closer to the bathhouse than necessary to provide easy ADA access but far enough so as to provide

a pleasant camping experience. Sidewalks through heavy vegetation should be signed to notify campers that the sidewalk leads to an ADA campsite. This will help avoid unintended surprise visits to the campsite.

An ADA campsite with asphalt paving and an ADA sidewalk in rear to the campground bathhouse - notice the vegetative screening providing privacy for the campsite

Security and Safety

Access – For safety reasons, most campgrounds have a single entrance which allows management to monitor and control access to the campground and facilities. However, many regulations require two or more accesses for emergency access in the event the main access becomes obstructed. You will need to check the local codes for the access requirements. Even if the codes call for dual access, having a divided 4-lane entrance may meet the requirements since the two exit lanes can be used for ingress/egress during emergencies if needed.

Pedestrian Clear Zones – Many campgrounds are set up so as to have many of the pedestrian routes located in the interior areas of the campground, but pedestrians will continue to use the roadways as well. So, if possible, provide a striped pedestrian lane along one side of the pavement for pedestrian use. Even if the pedestrian lane is needed by an RV for maneuvering to back into a campsite, it is for a short time and, typically, the pedestrians are a very accommodating group and will gladly avoid conflicts

with the RVs. Many of campers will even offer guidance to assist the driver in getting into the campsite. Remember to keep vehicular speeds ***slow*** since this is a campground... not a highway.

Interior pedestrian routes should be well maintained and provide routes that are easily traversed for people of all ages. Vegetation should be trimmed along the paths to eliminate or minimize hiding places for animals or people. Low level lighting is great for lighting the path without the glaring sodium-vapor lights that are an annoyance to adjacent campsites or so bright as to impair one's night vision.

Host campsites – Host campsites, if used, are strategically placed campsites that are reserved for employees or volunteers to provide security and assistance to the campground guests. When used, the host campsites should be located in areas that provide good visibility to the maximum number of campsites possible. Also, they should have signs indicating that they are host campsites and that the hosts are available to provide assistance if needed. These campsites provide a very economical yet effective means of minimizing campground vandalism, noise, and other annoyances. Additionally, host campsites should have full services... water, sewer, electricity... even when the campsite is located in a tent camping area.

Night Lighting - Night lighting is both good and bad. It is needed to provide safe access to the bathhouses but no one wants to be camping near a street light. So lighting should be limited to that which is necessary but no more. For the most part, the lighting can be limited to the bathhouses and primary roadways. Light fixtures that have shades to limit lighting to common areas and paths are best. Low level lights no more than 18-30 inches high are excellent for controlling night lighting on sidewalks and pedestrian paths through campgrounds.

Wayfinding
Road signage is a critical aspect of campground design for it provides a smooth and efficient means for drivers to locate their particular campsite. The signage needs to be highly visible without being obtrusive. So no flashing neon lights! If the campground roads are designed as one-way drives, they must be noticeably signed as such. Many campgrounds do not use street names for their drives but use

campsite numbers instead much like the methods used when you exit a hotel elevator when you're trying to locate your room. However, because of 911 addressing requirements, many jurisdictions are now requiring the use of street names and campsite numbers. Where this is required, you will also need to submit your street names for approval to ensure there are no names duplicated elsewhere in that jurisdiction. The sign posts and signs can be custom made but must comply with regulations for placement, size, color, and visibility.

Campsite signage may be handled in multiple ways but my preference for campgrounds with paved drives is for the numbers to be painted on the asphalt in 12-inch letters with reflective paint. The painted numbers are easy to read day or night and are also easily maintained. The numbers should be painted either in the center of the campsite driveway or adjacent to the drive's edge of pavement.

For unpaved drives, using a 4-inch or 6-inch post approximately 18-24 inches high with the number on the post painted in contrasting colors is recommended. You can also place the post between two campsites with the number and an arrow pointing to the appropriate campsite. This method can cut the number of posts needed in half. Informational signage can be provided using strategically placed kiosks and at the bathhouses. Directional signage to various campground facilities should also be readily visible so that guests can locate the campground administrative complex, campground store, swimming pool, laundry facilities, boat ramps, playgrounds, services, etc.

GROUP CAMPING

Because of the frequency of groups meeting to camp and socialize, it is recommended that a number of campsites be designed for groups. And because of the noise that these groups can generate, even if they're only having fun, they can be a bit of an annoyance to adjacent campers that are not part of the group. If a group camping area isn't established, the amount of pedestrian traffic generated as the groups begin congregating at a single campsite can become a problem for campers in the adjacent campsites. The size of the group camping area can sometimes be estimated by visiting other nearby campgrounds to discover the size of the group campsites that they are providing.

Social group camping can cause unintended disturbances from noise and frequent pedestrian traffic but also from lights and large campfires. Even mandatory "quiet time hours" are hard to enforce on groups as they feel they aren't being that noisy. It's a matter of perspective... are you part of the group or not?

A small 'group' camping area for two RVs travelling together - notice the increased RV drive width

As mentioned previously, large groups tend to have large campfires to accommodate a great number of people sitting around them in the evenings. For that reason, an area should be established for the large fires that are easily accessible, convenient yet somewhat remote from adjacent campsites, and have been cleared of combustible vegetation around and above the designated fire area.

CAMPGROUND DESIGN SUMMARY

As we have seen, campgrounds aren't quite as simple as we commonly think they are. It's easy to spot problems after the campground is built but by then it's too late. But when designed properly, they are very popular and used frequently. And with the current popularity of RVs, there is a growing demand for new campgrounds in new locations with new opportunities to explore the great outdoors. Engineers are great in

developing very efficient designs however most campers aren't looking for an efficiently designed campground. They want campgrounds that provide an escape from work... from crowds... from concrete. And they like having vegetated buffers between campsites for privacy and a sense of being outdoors. But the designs have to meet codes and regulations for stormwater, access, sanitation, and yet still be profitable for the owner. As we discussed, there are standards and regulations for all types of camping... primitive, tent, and RV. Obviously, no two campgrounds are alike but each can be successful if designed properly.

Like most things in life, "it's easy... if you know how." So, if you don't have that experience and knowledge, find an engineer who does. You, your client, and the campers who stay there will be glad you did.

And remember to design some really nice campgrounds because you may find yourself staying at some of these campgrounds once you retire... or maybe even before.

